

# Uninterruptible DC Power System

## BACKGROUND OF THE INVENTION

### 1. Field of the invention

5 The present invention relates to an uninterruptible DC power system, (DC UPS) and more particularly, to an uninterruptible DC power system to be served as an emergency power source which is capable of effectively reducing the line loss when applied to electric appliances attached with AC/DC switchable power suppliers(SW power).

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### 2. Description of the Prior Art

15 Utility electric power is relied on by common domestic consumers as their power source for electric appliances. In case of the occurrence of abnormal states such as power outage, an undervoltage, or a over voltage, or an abnormal frequency, the user's loads loose their power supply so that the uninterruptible power system (UPS) whose battery unit normally under floating charge state from the utility source takes over the responsibility  
20 for an emergency source to supply the emergency power to those user's loads which have lost the utility power supply.

Normally, the power output of a conventional UPS is in the form of AC. The operational principle of an UPS is inputting the AC utility power by way of an AC to DC converter so as to store  
25 the DC energy in the UPS by a DC charging circuit, and then supplies the stored DC electric power to the loads by converting

back to AC when the utility power is out thereby serving as a stand  
by power source. Meanwhile, in the aforesaid UPS scheme, the  
electric power is firstly converted from AC to DC, and then  
converted back from DC to AC, through repeated conversion of  
5 electric power as such, the electrical circuits used for such repeated  
conversion of power become complicated with increased circuit loss  
as well.

Therefore, an invention devoting to resolving aforesaid  
disadvantages of current UPS so as to upgrade the quality of the  
10 UPS is definitely necessary. The present inventor has delved into  
this matter with long time efforts and come to realization of the  
present invention.

## SUMMARY OF THE INVENTION

15 It is a first object of the present invention to provide a newly  
developed DC UPS which is capable of reducing electric power loss  
during conversion so as to improve the efficiency and effectiveness  
of the system, and start a lighting equipment in case the utility AC  
20 voltage becomes abnormal.

It is a second object of the present invention to provide a newly  
developed DC UPS which is capable of maintaining a stable output  
voltage without being influenced by the input source.

It is a third object of the present invention to provide a newly  
25 developed DC UPS which is capable of performing power  
conversion by only one stage so as to minimized the complexity of  
the circuit scheme and also improve environmental conscious  
effect.

To achieve the aforesaid objects, the DC UPS of the present invention is composed of at least a AC voltage and frequency detecting circuit, an AC to DC conversion and charging circuit, a DC voltage conversion circuit, a load detecting circuit, an output  
 5 voltage detecting circuit, and a control circuit. It is essentially emphasized that the invention is devoted to reducing the power loss owing to power conversion so as to improve the system efficiency and save energy. Moreover, the DC UPS of the present invention can maintain a stable output voltage, and by means of  
 10 detecting utility AC voltage, a lighting equipment can be turned on to illuminate surroundings in case the utility supply voltage is found to be abnormal.

## 15      **BRIEF DESCRIPTION OF THE DRAWINGS**

The above objects and other advantages of the present invention will become more apparent by describing in detail the preferred embodiments of the present invention with reference to  
 20 the attached drawings in which:

Fig. 1 is a layout scheme of the DC UPS in a first embodiment of the present invention;

Fig. 2 is a layout scheme of the DC UPS in a second embodiment of the present invention;

25      Fig. 3 is an electric circuit diagram of the DC UPS in a first embodiment of the present invention;

Fig. 4 is an electric circuit diagram of the DC IPS in a second

embodiment of the present invention; and

Fig. 5 is an illustrative diagram in which the DC UPS of the present invention is applied to an AC/DC switchable power supplier (SW power).

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## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The DC UPS provided by the present invention is well applicable to an electrical appliance using the SW power as its power supplier so as to reduce circuit loss due to power conversion and improve system efficiency and saving energy by only one stage conversion.

Except the complexity in the circuit design is minimized, the invention further contributes to environmental security protection and maintaining a stable output voltage.

Referring to Fig.1 and Fig.3, in which a layout scheme (Fig.1) and an electric circuit diagram (Fig.3) of the DC USP in a first embodiment of the present invention are shown. This embodiment belongs to an ON-LINE system which essentially comprises a lighting equipment 10, an AC voltage and frequency detecting circuit 11, an AC to DC conversion and charging circuit 12, a battery unit 13, a DC voltage conversion circuit 14, a load detecting circuit 15, an output voltage detecting circuit 16, an inner system power source 17, a controller circuit 18, and a switch

19. So far there is an utility AC available, a signal is delivered to the controller circuit 18 from the AC voltage and frequency detecting circuit 11 to actuate the AC to DC conversion and charging circuit 12 and the switch 19 for outputting DC power and  
 5 charging the battery unit 13.

After finishing charging the battery unit 13, a notification signal is sent to the controller circuit 18 for interrupting the charging circuit 12 so as to protect the battery unit 13. In case the voltage, or frequency etc. of the utility AC power is found to be  
 10 abnormal, the controller circuit 18 is informed by the AC voltage and frequency detecting circuit 11 of this state so as to start operation of the DC voltage conversion circuit 14 for continuously supplying power to the loads thereby attaining the uninterrupted power supply, and turn on the lighting equipment 10 to illuminate  
 15 surroundings.

The inner system power source 17 is for supplying power to the inner components of UPS. Besides, the controller circuit 18 can control the output voltage at a predetermined value according to the detected results obtained by the output voltage detecting  
 20 circuit 16. And, the load detecting circuit 15 is for detecting whether there is an overloading at the output terminal and informing the controller circuit 18 of the detected results.

In the first embodiment, in addition to servicing for the electric appliances equipped with the SW power, a DC to AC  
 25 inverter may be added to the present invention for supplying AC power to other appliances which have no attached SW power.

Referring to Fig.2 and Fig.4, in which a layout scheme (Fig.2) and an electric circuit diagram (Fig.4) of the UPS in a second embodiment of the present invention are shown. This embodiment belongs to an OFF-LINE system which essentially comprises a lighting equipment 20, an AC voltage and frequency detecting and charging circuit 21, a battery unit 22, a DC to AC conversion circuit 23, a load detecting circuit 24, and output voltage detecting circuit 25, an inner system power source 26, a controller circuit 27, and an electromagnetic switch 28. So far there is an utility AC input, the AC voltage and frequency detecting and charging circuit 21 delivers a signal to the battery unit 22 informing that it is to be charged and informing the controller circuit 27 for actuating the electromagnetic switch 28 to output an AC power.

When finished charging of the battery unit 22, a signal is sent to the controller circuit 27 to stop charging so as to protect the battery unit 22 from being overcharged. In case the voltage, or frequency etc. of the utility AC power is found to be abnormal, the controller circuit 27 is informed by the AC voltage and frequency detecting and charging circuit 21 of this state so as to start operation of the DC voltage conversion circuit 23 and the electromagnetic switch 28 continuously supplying power to the loads thereby attaining the aim of uninterrupted power supply.

The inner system power source 26 is for supplying power to the inner components of UPS. Besides, the controller circuit 27 can control the output voltage at a predetermined value according

to the detected results obtained by the output voltage detecting circuit 25. And, the load detecting circuit 24 is for detecting whether there is an overloading at the output terminal and informing the controller circuit 27 of the detected results.

5           In the second embodiment, in addition to servicing for the appliances equipped with the SW power, a DC to AC inverter may be added to the present invention for supplying AC power to other appliances which have no attached SW power.

Referring to the illustrative diagram shown in Fig. 5 in which  
the UPS of the present invention is applied to an AC/DC  
switchable power supplier(SW power). If the utility AC power  
supply is working normally, the power is stored in a battery unit  
31 after AC to DC conversion. In case the utility power fails to  
keep its normal state which being detected by a detecting circuit  
32, a controller circuit 33 sends a signal to an electromagnetic  
switch 35 of a SW power 34 which actuates a DC voltage  
conversion circuit 36 to produce a high DC voltage. This high DC  
voltage is stepped down to a low voltage DC as an output power  
via another DC voltage conversion circuit 37.

20           It emerges from the description of the above embodiments that  
the invention has several noteworthy advantages which are not  
found in any conventional UPS, in particular;

1.The power loss in conversion is reduced which leads to energy saving and improving system efficiency.

25        2.The output voltage is not affected by variation of the input  
voltage so that the UPS of the present invention can always

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1. The first step in the process is to identify the problem or issue that needs to be addressed. This involves gathering information and understanding the context of the problem.